

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicants: TETSUKA et al

Serial No.: 10/784,275

Filed: February 24, 2004

For: Plasma Processing Apparatus And Plasma Processing Method

Art Unit: 1792

Examiner: R. Zervigon

Conf. No.: 8920

**REPLY BRIEF**

Mail Stop: Appeal - Patent (Fee)  
Commissioner For Patents  
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July 28, 2008

Sir:

This Reply Brief is submitted in response to the Examiner's Answer dated May 28, 2008.

In rejecting the claims, the Examiner modifies Kadomura (US 6391437) based upon the teachings of Kawasaki (US 4795529), contending that it would be obvious to make such combination, while ignoring the fact that Kawasaki et al issued in 1989, and irrespective of the teachings thereof, such teachings are based upon considerations of the art at such time, and that Kadomura had access to such teachings, since Kadomura was filed some 10 years later in 1998, but that Kadomura, which was based upon consideration of the art some 10 years later, did not adopt the teachings of Kawasaki.

More particularly, claim 1, the only independent claim on appeal, recites the features of a plasma processing apparatus having a reaction chamber, wherein a

“dielectric that is exposed to the plasma substantially covers a surface portion of an inner wall of the reaction chamber, an electrically conductive member is disposed within the reaction chamber so as to be exposed to the plasma within the reaction chamber at a position with respect to the inner wall of the reaction chamber, which is covered with the dielectric” (emphasis added) and that “the electrically conductive member has an area in a range of 0.1% to 10% of the inner wall area of the reaction chamber”. (emphasis added), and that “the electrically conductive member forming the DC earth is disposed at a position crossing a magnetic line of force that is closer to the substrate holder than a magnetic line of force that crosses the inner wall of the reaction chamber having the dielectric thereon.” (emphasis added).

In applying Kadomura to the claimed invention, the Examiner recognizes at page 4 and subsequent pages of the Examiner’s Answer what “Kadomura does not teach”, including the fact that Kadomura does not teach an electrically conductive member is disposed within the reaction chamber so as to be exposed to the plasma within the reaction chamber at a position with respect to the inner wall of the reaction chamber. Appellants note that Kadomura apparently discloses one embodiment in Fig. 8, of a processing chamber 61, wherein the inner wall 61A is made of an aluminum block (column 31, lines 2 and 3), i.e., without a dielectric, and another embodiment, as illustrated in Fig. 13, for example, wherein the inner wall 21A of the processing chamber 21 is a metal layer which is completely covered with a dielectric, such as the dielectric in the form of the ceramics layer 113 or 116, as illustrated in Figs. 21A or 21B as referred to by the Examiner. It is noted that in neither embodiment does Kadomura disclose or teach an electrically conductive member disposed at a position with respect to the inner wall of the reaction chamber which is

covered with the dielectric, as recited in claim 1 and the dependent claims of this application.

The Examiner, recognizing the deficiency of Kadomura, cites Kawasaki, and appellants submit that the Examiner has mischaracterized the disclosure of Kawasaki in relation to the claimed invention, as is apparent from the description at page 11 of the Examiner's Answer. More particularly, the Examiner refers to the reaction or processing chamber of Kawasaki as being formed of elements 4 and 1, as illustrated in Fig. 7 of Kawasaki. Kawasaki indicates that a discharge tube 1 made of silica is disposed at an upper opening of a vacuum treating vessel 4 and appellants submit that at the time of the invention of Kawasaki, as was well known in the art, the inner walls of the vacuum treating vessel 4 were made of metal, because the exhaust port and the wafer holder at the lower part of the treating vessel 4 were generally made of metal, and the gas introduction portion 2 would also be made of metal, since it is in the form of a large flange on which the discharge tube 1 made of silica is disposed. Appellants submit that at the time of the invention of Kawasaki, in 1989, heavy metal contamination from the metal inner wall of the reaction chamber was not considered a problem, but such metal contamination became a recognized problem in the years after Kawasaki. Thus, there is no disclosure in Kawasaki that the inner wall 4 of the reaction chamber has a dielectric covering a surface portion of the inner wall of the reaction chamber which is exposed to the plasma. While Kawasaki discloses a ground electrode 11 disposed around the outer periphery of the electrode 5, as is readily apparent, the ground electrode 11 is not disposed within the reaction chamber at a position with respect to the inner wall of the reaction chamber which is covered with the dielectric, and the ground electrode 11 does not

have an area in a range of 0.1% to 10% of the inner wall area of the reaction chamber, nor the other features of claim 1.

Years later, at the time of filing of Kadomura, a problem of fluctuation of process performances caused by heavy metal contamination from wall surfaces and wall chipping, was given consideration. To overcome such problem, in accordance with the disclosure and teaching of Kadomura, as represented by the embodiment of Fig. 13, the inner walls 21A of the reaction chamber were "completely" covered with a dielectric, and as pointed out above, Kadomura et al discloses completely covering the inner walls of the inner chamber, and provides no disclosure or teaching of an electrically conductive member disposed within the reaction chamber so as to be exposed to the plasma within the reaction chamber at a position with respect to the inner wall of the reaction which is covered with the dielectric, nor the other features of claim 1. It is apparent that since Kadomura provides no disclosure of an electrically conductive member, Kadomura does not disclose an electrically conductive member which forms a DC earth, and which has an area in a range of 0.1 % to 10 % of the inner wall area of the reaction chamber, as recited in claim 1.

As described at pages 1 and 2 of the specification of this application, under the heading "DESCRIPTION OF THE RELATED ART" in prior plasma etching apparatuses, the inner walls of the reaction chamber were damaged by ion sputtering due to high frequency power, and the inner wall material of the reaction chamber was chemically eroded by the reactive gas, causing metal contained in the wall material to enter the processed wafer and cause deterioration of the LSI circuit performance. Appellants submit that such description is representative of the apparatus of Kawasaki. Furthermore, as described in the first full paragraph at page 2 of the specification "In order to cope with this problem, in recent plasma

processing apparatuses, the surface of components in the apparatus such as the inner walls of the reaction chamber and the substrate holder are coated with a non-conductive (dielectric) material... " (emphasis added), which is representative of the teachings of Kadomura. As described in connection with Figs. 6 and 7 of the drawings of this application, wherein Fig. 7 describes the problem of a reaction chamber having a dielectric coating on the inner wall surface thereof, that the high frequency can be propagated through the dielectric and the inner wall functions as earth for the high frequency even with the dielectric coating resulting in unstable behavior and wall chipping. Appellants note that prior art, referred to as Patent Document 1 and Patent Document 2 in the specification of this application, describe the use of earth points or earth electrodes within the processing chamber, and describe problems occurring with such structure at pages 7 and 8 of the specification of this application. More importantly, based upon the problems described with respect to the prior art, as set forth in the first full paragraph at page 10 of the specification, under the heading "SUMMARY OF THE INVENTION":

In order to solve the above-mentioned problems, the present invention covers 90% or more of the area of the inner wall of the reaction chamber with dielectric and provides on the inner wall of the reaction chamber a DC earth formed of an earth conductive member having an area of less than 10% on the inner wall so that direct current flows therein from the plasma. (emphasis added).

Appellants submit that the aforementioned features of the present invention are recited in independent claim 1 and the dependent claims on appeal, and the problems and the solution to the problems, as recognized by the inventors of this application were not recognized by Kawasaki or Kadomura, nor did such references suggest the combination of features, as recited in claim 1 and the dependent claims of this application.

Assuming arguendo, that some how, irrespective of the fact that Kadomura did not disclose or teach an electrically conductive member within the reaction chamber at a position with respect to the inner wall of the reaction chamber which is covered with the dielectric, and, assuming arguendo, that the grounded electrode 11 of Kawasaki could be placed within the reaction chamber of Kadomura, as contended by the Examiner, applicants submit the resultant structure would not provide the recited features of the present invention as indicated at page 10 of the specification and recited in claim 1 that "the electrically conductive member has an area in a range of 0.1% to 10% of the inner wall area of the reaction chamber" (emphasis added), that "the electrically conductive member is electrically coupled to earth one of directly and through the inner wall of the reaction chamber so as to form a DC earth which enables direct current to flow therein from the plasma"; and that "the electrically conductive member forming the DC earth is disposed at a position crossing a magnetic line of force that is closer to the substrate holder than a magnetic line of force that crosses the inner wall of the reaction chamber having the dielectric thereon". Appellants submit that such features, as described in the specification of this application, enable the problems of prior art constructions, as represented by Kadomura and Kawasaki, to be overcome.

With respect to the structural limitation of the range of the area of the electrically conductive member with respect to the inner wall area covered by the dielectric, the Examiner indicates that at page 14 of the Examiner's Answer, it can be concluded that Kawasaki's electrically conductive member is that it has a smaller area percentage than the inner wall area of Kawasaki's reaction chamber. The Examiner then indicates that at the top of page 15, a skilled artisan would find it obvious at the time the invention was made to optimize the dimensions for example,

to accommodate varying size substrates and/or reduce apparatus' working area relative to the rest of the fabrication facility. In addition the fact that Kawasaki does not disclose the inner wall 4 of the reaction chamber being covered with the dielectric, nor the location of the grounded electrode 11 with respect to the inner wall covered with the dielectric, the fact that looking to the drawings of Kawasaki, the area covered by the grounded electrode is smaller does not provide the area relationship, as recited in claim 1, and considered to be a feature of the present invention. Thus, the Examiner's position is improper and does not relate to the claimed subject matter.

Furthermore, with respect to the additional limitation of claim 1 concerning the location of the electrically conductive member forming the DC earth at a position crossing a magnetic line of force that is closer to the substrate holder than a magnetic line of force that cross the inner wall of the reaction chamber having the dielectric thereon, the Examiner again refers to Kawasaki, which does not have an inner wall covered with a dielectric, and contends that such is an intended use limitation, and apparently contends that such feature can be disregarded. Hereagain, this position by the Examiner is not understood, since the feature recites a location of the electrically conductive member, which is not divided by Kawasaki, such that applicants submit that the Examiner's position does not relate to the claimed features of claim 1.

For the foregoing reasons, appellants submit that the suggested modification of Kadomura by Kawasaki is a hindsight reconstruction attempt, which does not result in the claimed features nor solve the problems recognized by the inventors of this application. Accordingly, appellants submit that claim 1 recites features which

patentably distinguish over the cited art and should be considered allowable thereover.


With respect to the features of the dependent claims, the Examiner recognizes that such features are not disclosed or taught in the cited art, but contends it would be obvious to provide such features, which again, is improper, noting that appellants have previously set forth the differences with respect to the features of the dependent claims and the cited art.

For the foregoing reasons, appellants request reversal of the rejection of the claims as set forth by the Examiner.

To the extent necessary, applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to the deposit account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (Case: 648.43518X00), and please credit any excess fees to such deposit account.

Respectfully submitted,

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